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Original Research Article

ASSESSING HYPOGLYCEMIA INCIDENCE AMONG BREASTFED NEONATES

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ABSTRACT

Background: Neonates possess a finely tuned adaptation system that regulates blood sugar levels within a safe range during extrauterine life. Nevertheless, specific intrauterine risk factors can disrupt this adaptive system, resulting in hypoglycemia during the early post-natal period. This research was conducted at a tertiary care hospital in Gujarat to investigate the incidence of hypoglycemia and the associated risk factors.

Material and Methods: A total of 150 newborns participated in this study. All newborns who were promptly transferred to their mothers post-delivery, regardless of whether the birth was vaginal or via caesarean section, were included in the study after securing parental consent. Capillary blood sugar levels were monitored at 1, 3, 6, 12, 24, 48, and 72 hours after birth. Neonates exhibiting capillary blood glucose levels below 40 were classified as hypoglycemic. All infants experiencing hypoglycemia underwent thorough assessments to identify various intrauterine and post-natal risk factors.

Results: In a study involving 150 enrolled cases, it was observed that 24 individuals experienced hypoglycemia within the first 72 hours of life. The occurrence of hypoglycemia observed in our study was 16%. Hypoglycemia occurred more frequently in neonates born to mothers under the age of 30; however, this association was not statistically significant. The incidence of hypoglycemia was observed to be higher in infants born via LSCS. In our research, we analysed a total of 150 enrolled cases, of which 112 were classified as term, 30 as preterm, and 8 as post term. Our research identified 20 instances classified as small for gestational age (SGA). Among these, 13 were categorised as Term SGA, while 7 were identified as Preterm SGA.

Conclusion: Hypoglycaemia frequently occurs in the post-natal ward, particularly among high-risk neonates, those born via LSCS deliveries, and first-time mothers who may lack confidence in breastfeeding. Monitoring capillary blood glucose in these instances can identify numerous asymptomatic hypoglycemic neonates. Timely and appropriate management can avert the onset of symptoms and help prevent both early and delayed neurological complications.

Key Words: Capillary Blood Glucose, Hypoglycaemia, Neonates, Preterm.

INTRODUCTION

The foetus obtains glucose during its intrauterine development through facilitated diffusion from the maternal circulation via the placenta. The enzymes essential for gluconeogenesis exhibit minimal activity, reflecting the low demand for glucose production in the body.[1] At birth, when the placental circulation is reduced, various metabolic adaptations take place in the neonate to meet the demand for glucose supply. At birth, the glucose requirements for neonates are approximately 5 to 8 mg/kg per minute, primarily for cerebral utilisation. Neonates obtain glucose from external sources, such as milk, as well as through internal processes like glycogenolysis, gluconeogenesis, and ketogenesis, provided that sufficient substrates are present. The hormonal changes that take place at birth play a

crucial role in enhancing endogenous glucose production. Immediately following birth, there is an increase in the production of glucagon and catecholamines, which plays a crucial role in the breakdown of glycogen.1Within a few hours after birth, there is a notable increase in growth hormone and cortisol levels, which plays a crucial role in the process of gluconeogenesis.[2] Insulin secretion is also declining, resulting in a decrease in serum insulin concentration.[3] The start of milk feeding plays a crucial role in gluconeogenesis and supports ketogenesis, thereby preserving glucose for brain utilisation.[4] A defect in any adaptive pathway can lead to hypoglycemia during post-natal life, particularly in situations involving fasting.[2]

Neonatal hypoglycemia represents a prevalent metabolic issue, particularly when risk factors for hypoglycemia are present. Hypoglycemia in newborns is characterized by a blood glucose level that falls below 47 mg/dl.2 Several risk factors contribute to the occurrence of hypoglycemia, including being an infant of a diabetic mother, large for gestational age (LGA), small for gestational age (SGA), low birth weight, and preterm birth. The developing foetus relies completely on the maternal supply and the placental transfer of essential nutrients such as glucose, amino acids, free fatty acids, ketones, and glycerol to meet its energy requirements. The typical lower threshold for foetal glucose levels hovers around 54 mg/dL throughout much of gestation, especially post the 20-week mark.[5.6] The regulation of glucose levels through the initiation of glucose production is a vital physiological process, facilitating a seamless transition and adaptation to life outside the womb. Some newborns experience challenges during their transition to life outside the womb, which can lead to disruptions in glucose regulation and lower plasma glucose levels.

Hypoglycemia can present with various symptoms, including lethargy, irritability, jitteriness, apnoea, and seizures, but it may also occur without any noticeable clinical signs, remaining completely asymptomatic. Symptomatic hypoglycemia has been linked to negative neurodevelopmental outcomes, while the effects of asymptomatic hypoglycemia on neurodevelopment remain unclear. It is crucial to address the treatment of asymptomatic hypoglycemic infants, considering the potential negative long-term consequences that may arise. 7.8

Effective glucose monitoring during the post-natal period is crucial for the early detection of hypoglycaemia and plays a significant role in preventing neurological complications in the future. In light of this context, the present study was conducted at a tertiary care hospital in Gujarat to investigate the incidence of hypoglycemia and the associated risk factors.

MATERIALS AND METHODS

A cross-sectional study was carried out at the Department of Paediatrics in a Tertiary Care Teaching Institute in India over the course of one year. A total of 150 newborns were included in this study. All newborns who were promptly transferred to their mothers post-delivery, encompassing both vaginal and caesarean sections, were included in the study after parental consent was secured. A newborn requiring NICU admission at birth was subsequently step-downed from the NICU. Newborns with significant congenital anomalies and those in whom anything other than breast milk was introduced were excluded from this study.

The estimation of capillary blood glucose was conducted using the heel prick method, following confirmation that the heel was adequately warmed. Capillary blood glucose levels were monitored at 1, 3, 6, 12, 24, 48, and 72 hours after birth. In cases where a newborn is identified with hypoglycemia, the infant is promptly managed according to established treatment protocols.

Infants delivered prior to 37 completed weeks are classified as preterm, whereas those born between 37 and 42 completed weeks are categorised as term neonates. Infants delivered after 42 full weeks of gestation are classified as post-term. Infants with a weight of less than 2.5 kilogrammes are classified as having low birth weight, whereas those weighing between 2.5 kilogrammes and 4 kilogrammes fall within the normal birth weight range. Infants who weigh over 4 kilogrammes are classified as macrosomic. Infants who weigh below the 10th percentile for their gestational age are classified as small for gestational age (SGA). Those with weights ranging from the 10th to the 90th percentile are deemed appropriate for gestational age (AGA), while infants exceeding the 90th percentile are categorised as large for gestational age (LGA).

Statistical Analysis

The collected data was systematically organised and input into a spreadsheet application (Microsoft Excel 2019) before being transferred to the data editor interface of SPSS version 19 (SPSS Inc., Chicago, Illinois, USA). Quantitative variables were characterised using means and standard deviations or medians and interquartile ranges, depending on their distribution. Qualitative variables were reported in terms of counts and percentages. The confidence level for all tests was established at 95%, while the level of significance was determined to be 5%.

RESULTS

A total of 150 cases were enrolled in this study according to the established inclusion criteria. The demographics of the enrolled cases are presented in Table 1. Among the 150 enrolled cases, 24 experienced hypoglycemia within the first 72 hours

of life. The occurrence of hypoglycemia observed in our study was 16%. The occurrence of hypoglycemia was marginally higher in male infants; however, this correlation did not reach statistical significance.

Our research indicates that the majority of hypoglycemia cases were observed in primigravida mothers. Hypoglycemia occurred more frequently in neonates born to mothers under the age of 30; however, this association did not reach statistical significance. The data indicates a higher incidence of hypoglycemia in infants born via caesarean section, as shown in Table 2.

Among the 24 infants diagnosed with hypoglycemia, 14 were male and 10 were female. In our research, among the 150 enrolled cases, 112 were classified as term, 30 as preterm, and 8 as post term. Our research identified 20 instances of small for gestational age (SGA). Among these, 13 were classified as Term SGA, while 7 were categorised as Preterm SGA. Our research revealed that 48 infants were delivered with low birth weight. Five cases were identified as large for gestational age, and all of these cases were classified as term LGA.

In our investigation, among 17 cases of Term/AGA/LBW, 5 individuals experienced hypoglycemia. Among the 9 cases of term, small for gestational age, and low birth weight infants, 3 exhibited signs of hypoglycemia. Among the preterm low birth weight infants, 16 were classified as appropriate for gestational age. Among the 16 infants studied, 6 experienced hypoglycemia, with 3 out of the 6 cases occurring in preterm small-for-gestational-age babies who had hypoglycemic episodes. Among the total of 48 LBW cases, there were 15 instances of hypoglycemia observed. In a study involving 99 infants of normal birth weight, 8 experienced episodes of hypoglycemia within the first 72 hours of life. Notably, the association between these occurrences was determined to be statistically significant. Our study identified 11 instances of infants born to diabetic mothers, with 8 cases classified as term and 3 as preterm. Among the 5 individuals with Term/AGA/IDM, 4 experienced hypoglycemia. Among the 112 term infants studied, 13 were diagnosed with hypoglycemia. The results of this study demonstrated a statistically significant outcome. Statistical significance was observed with a p-value of less than or equal to 0.05.

Table 1: Demographic profile of enrolled cases

Demographic profile	Number	Percentage (%)
Gender		
Male	78	52
female	72	48
Gravida		
Primi gravida	90	60
Multi gravida	60	40
Maternal age (in years)		
<30	93	62
>30	57	38
Mode of delivery		
Vaginal Delivery	65	43.3
LSCS	85	56.6

Table 2: Distribution of hypoglycemia in terms of sex and maternal factors

Variable	Number of hypoglycemic neonates	Percentage (%)	P value
Gender			
Male (78)	14	58.33	0.90
Female (72)	10	41.66	
Gravida			
Primigravida (90)	16	66.6	0.1
Multipara (60)	8	33.33	
Maternal age			
<30 (93)	18	75	0.58
>30 (57)	6	25	
Mode of delivery			
Vaginal Delivery (65)	7	29.16	0.08
LSCS (85)	17	70.83	

*** Indicate statistically significance at p≤0.05**

Table 3: Distribution of hypoglycemia according to gestational age

Gestational age	Total cases	Hypoglycemia present n (%)	P value
Pre term	30	11 (36.6)	0.09
Term	112	13 (11.6)	0.02*
Post term	8	0	0.25

*** Indicate statistically significance at p≤0.05**

DISCUSSION

Reports indicate a significant variation in the incidence of hypoglycemia globally. The occurrence of hypoglycemia is influenced by the screening methods employed, the frequency of these screenings, and the feeding practices in place. Currently, there is no widely recognized Point-Of-Care (POC) method that can accurately and reliably identify low blood glucose levels, making it unsuitable as the sole screening tool for hypoglycemia in at-risk newborns. There is significant variability in the collection and processing of blood samples for glucose concentration analyses, and the incidence of these variations also differs accordingly. Breastfeeding serves as the primary approach for addressing asymptomatic hypoglycemia. Various units implement distinct protocols for the management of asymptomatic hypoglycemia. Numerous units opt to provide sugar-fortified feeds or supplementary formula feeds. The occurrence of hypoglycemia is influenced by different protocols and feeding strategies.[6.7]

Our research indicates that 16% of the 150 neonates admitted to the post-natal ward experienced hypoglycemia within the first 72 hours of life, totaling 24 cases. Various studies conducted globally have reported differing rates of hypoglycemia among infants who are exclusively breastfed.[8] The variations in incidence rates observed across different studies can be attributed to a multitude of factors. Various studies conducted globally have established differing cutoff levels for diagnosing hypoglycemia.[9,10]

The current study indicates that the incidence of hypoglycemia is somewhat higher in male infants compared to their female counterparts. Nonetheless, this result did not reach statistical significance. Various studies conducted globally have shown no significant sex preference regarding hypoglycemia in neonates. The study conducted by Holtrop et al. reported that the incidence of hypoglycemia in small for gestational age (SGA) infants was 14.7%.[11] The study conducted by Bhat et al. revealed that the incidence of hypoglycemia among small for gestational age (SGA) infants was 25.2%.[12] The study conducted by De et al. revealed that the incidence of hypoglycemia in small for gestational age (SGA) infants was 64.2%. However, it is important to note that the sample size was quite limited.[13]

The current study found a higher incidence of hypoglycemia in infants born to primigravida mothers, as well as in those born to mothers under the age of 30. While these associations did not reach statistical significance, the rise in hypoglycemia incidence among first-time and younger mothers may be linked to a lack of experience in breastfeeding practices. This observation aligns with findings from other studies, suggesting that first-time mothers may encounter more challenges associated with breastfeeding.[14] Consequently, infants born to this demographic of mothers require more vigilant monitoring for hypoglycemia.

Our research revealed that 30% of all low-birth-weight infants experienced episodes of hypoglycemia within the first 72 hours of life, and this finding shows a statistically significant correlation. In a similar vein, we observed that 38.8% of the total preterm neonates experienced episodes of hypoglycemia. Our research revealed that 28% of term small for gestational age (SGA) infants and 50% of preterm SGA infants experienced hypoglycemia. Prematurity, low birth weight, and being small for gestational age are recognized risk factors for hypoglycemia. Numerous studies conducted across the globe in recent decades have substantiated this fact. Hyperinsulinism and elevated calorie expenditure for thermoregulation contribute to hypoglycemia in low birth weight and small for gestational age infants. In small for gestational age (SGA) infants, there is a notable relative excess of glucose-dependent tissues, characterised by a high brain-to-liver ratio.[15,16]

Our findings reveal a notable connection between term and normal birth weight infants and the occurrence of hypoglycemic episodes. Nonetheless, a majority of these instances presented additional risk factors, such as infants of diabetic mothers and large or small for gestational age babies. Bhat and colleagues encompassed all small for gestational age newborns, regardless of whether they were breastfed, formula-fed, or receiving intravenous fluids. Their studies may have seen a reduction in the incidence of hypoglycemia due to these factors.[16] A study conducted by Singhal et al. revealed that the incidence of hypoglycemia was 12.8% in preterm infants, in contrast to 3.6% observed in term infants.[14] Nancy Wight has discovered that the clinical manifestations of hypoglycemia are nonspecific and can present alongside a range of other neonatal issues.[17]

The study's limitation lies in its small sample size, which restricts the ability to generalise the findings effectively. Given that the research was carried out at a single institution, caution is advised when extrapolating the findings to the broader population.

CONCLUSION

Hypoglycaemia is quite common in post-natal ward specially in high-risk neonates, LSCS deliveries and in primi mothers with lack of confidence in breastfeeding. Capillary blood glucose monitoring in these cases may diagnose many asymptomatic hypoglycaemic neontates and proper management at appropriate time may prevent neonates to become symptomatic and prevent early and delayed neurological complication. So, newborns with risk factors for hypoglycemia should be screened at regular interval for blood glucose level more

specifically at first 24 hours of life to enable us to support breastfeeding to prevent hypoglycemia and potential neurodevelopmental damage.

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